

WHAT IS CLAIMED IS:

- 1                    1.     An isolated nucleic acid encoding a polypeptide comprising an  
2     alpha subunit of a KCNQ potassium channel, the polypeptide:  
3                    (i) forming, with at least one additional KCNQ alpha subunit, a  
4     KCNQ potassium channel having the characteristic of voltage-gating; and  
5                    (ii) comprising a subsequence having at least 65% amino acid  
6     sequence identity to amino acids 343 to 640 of SEQ ID NO:4.
- 1                    2.     The nucleic acid of claim 1, wherein the polypeptide specifically  
2     binds to antibodies generated against SEQ ID NO:4 or SEQ ID NO:5.
- 1                    3.     The nucleic acid of claim 1, wherein the polypeptide encodes  
2     human KCNQ5.
- 1                    4.     The nucleic acid of claim 1, wherein the nucleic acid encodes an  
2     amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.
- 1                    5.     The nucleic acid of claim 1, wherein the nucleic acid comprises a  
2     nucleotide sequence of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3.
- 1                    6.     The nucleic acid of claim 1, wherein the nucleic acid is amplified  
2     by primers that selectively hybridize under stringent hybridization conditions to the same  
3     sequence as the primers selected from the group consisting of:  
4                    CCACGTCTGCACTCAGGAAGTCTCCG (SEQ ID NO:6)  
5                    CCAGCTTGGATTCTATGGACTGTACC (SEQ ID NO:7)  
6                    GAAGAGCCGAGAGAAAATAACAGCAG (SEQ ID NO:8)  
7                    GCCCTGTGGATAGCAAAGATCTTTCG (SEQ ID NO:9)  
8                    GCTGTGAGCATAAACCCTGAACCC (SEQ ID NO:10)  
9                    CCATGCGCACCATGCGGAGGATCTG (SEQ ID NO:11)  
10                    CATGAAGGATGTGGAGTCGGG (SEQ ID NO:12) and  
11                    TGGCTAAAGAACTGCTATGCCTGG (SEQ ID NO:13).
- 1                    7.     The nucleic acid of claim 1, wherein the polypeptide encoded by  
2     the nucleic acid comprises an alpha subunit of a homomeric potassium channel.

- 1                   8.     The nucleic acid of claim 1, wherein the polypeptide encoded by  
2 the nucleic acid comprises an alpha subunit of a heteromeric potassium channel.
- 1                   9.     The nucleic acid of claim 1, wherein the nucleic acid selectively  
2 hybridizes under moderately stringent hybridization conditions to a nucleotide sequence  
3 of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3.
- 1                   10.    An isolated nucleic acid encoding a KCNQ polypeptide, the  
2 nucleic acid specifically hybridizing under stringent conditions to a nucleotide sequence  
3 of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3.
- 1                   11.    An isolated nucleic acid that specifically hybridizes under stringent  
2 conditions to a nucleic acid encoding an amino acid sequence of SEQ ID NO:4 or SEQ  
3 ID NO:5.
- 1                   12.    A method of detecting a nucleic acid, the method comprising  
2 contacting the nucleic acid with an isolated nucleic acid of claim 1.
- 1                   13.    An isolated polypeptide comprising an alpha subunit of a KCNQ  
2 potassium channel, the polypeptide:  
3                   (i) forming, with at least one additional KCNQ alpha subunit, a  
4 KCNQ potassium channel having the characteristic of voltage-gating; and  
5                   (ii) comprising a subsequence having at least 65% amino acid  
6 sequence identity to amino acids 343 to 640 of SEQ ID NO:4.
- 1                   14.    The polypeptide of claim 13, wherein the polypeptide specifically  
2 binds to antibodies generated against SEQ ID NO:4 or SEQ ID NO:5.
- 1                   15.    The polypeptide of claim 13, wherein the polypeptide has a  
2 molecular weight of between about 95 kD to about 104 kD.
- 1                   16.    The polypeptide of claim 13, wherein the polypeptide has an amino  
2 acid sequence of human KCNQ5.
- 1                   17.    The polypeptide of claim 13, wherein the polypeptide has an amino  
2 acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

1 18. The polypeptide of claim 13, wherein the polypeptide comprises an  
2 alpha subunit of a homomeric potassium channel.

1 19. The polypeptide of claim 13, wherein the polypeptide encoded by  
2 the nucleic acid comprises an alpha subunit of a heteromeric potassium channel.

1 20. An antibody that specifically binds to the KCNQ polypeptide of  
2 claim 13.

1 21. The antibody of claim 20, wherein the polypeptide to which the  
2 antibody binds has an amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

1 22. An expression vector comprising the nucleic acid of claim 1.

1 23. A host cell transfected with the vector of claim 22.

1 24. A method for identifying a compound that increases or decreases  
2 ion flux through a potassium channel, the method comprising the steps of:

3 (i) contacting the compound with a KCNQ polypeptide, the polypeptide

4 (a) forming, with at least one additional KCNQ alpha subunit, a  
5 KCNQ potassium channel having the characteristic of voltage-gating; and

6 (b) comprising a subsequence having at least 65% amino acid  
7 sequence identity to amino acids 343 to 640 of SEQ ID NO:4; and

8 (ii) determining the functional effect of the compound upon the potassium  
9 channel.

1 25. The method of claim 24, wherein the functional effect is a physical  
2 effect.

1 26. The method of claim 24, wherein the functional effect is a chemical  
2 effect.

1 27. The method of claim 24, wherein the polypeptide is expressed in a  
2 eukaryotic host cell or cell membrane.

- 1                    28.    The method of claim 27, wherein the functional effect is  
2    determined by measuring ion flux, changes in ion concentrations, changes in current or  
3    changes in voltage.
- 1                    29.    The method of claim 24, wherein the functional effect is determined  
2    by measuring ligand binding to the channel.
- 1                    30.    The method of claim 24, wherein the polypeptide is recombinant.
- 1                    31.    The method of claim 24, wherein the potassium channel is  
2    homomeric.
- 1                    32.    The method of claim 24, wherein the potassium channel is  
2    heteromeric.
- 1                    33.    The method of claim 24, wherein the polypeptide is human KCNQ5
- 1                    34.    The method of claim 24, wherein the polypeptide has an amino acid  
2    sequence of SEQ ID NO:4 or SEQ ID NO:5.
- 1                    35.    A method of modulating ion flux through a KCNQ potassium  
2    channel, the method comprising the step of contacting the KCNQ potassium channel,  
3    wherein the channel comprises a KCNQ5 alpha subunit, with an therapeutically effective  
4    amount of a compound identified using the method of claim 24.
- 1                    36.    A method for identifying a compound that increases or decreases  
2    ion flux through a potassium channel comprising a KCNQ5 polypeptide, the method  
3    comprising the steps of:  
4                    (i) entering into a computer system an amino acid sequence of at least 50  
5    amino acids of a KCNQ5 polypeptide or at least 150 nucleotides of a nucleic acid  
6    encoding the KCNQ5 polypeptide, the KCNQ5 polypeptide comprising a subsequence  
7    having at least 65% amino acid sequence identity to amino acids 343 to 640 of SEQ ID  
8    NO:4;  
9                    (ii) generating a three-dimensional structure of the polypeptide encoded by  
10    the amino acid sequence;

(iii) generating a three-dimensional structure of the potassium channel comprising the KCNQ5 polypeptide;  
(iv) generating a three-dimensional structure of the compound; and  
(v) comparing the three-dimensional structures of the polypeptide and the compound to determine whether or not the compound binds to the polypeptide.

37. A method of detecting the presence of hKCNQ5 in human tissue, the method comprising the steps of:

(i) isolating a biological sample;  
(ii) contacting the biological sample with an hKCNQ5-specific reagent that selectively associates with hKCNQ5; and,  
(iii) detecting the level of hKCNQ5-specific reagent that selectively associates with the sample.

38. The method of claim 37, wherein the hKCNQ5-specific reagent is selected from the group consisting of: hKCNQ5-specific antibodies, hKCNQ5-specific oligonucleotide primers, and hKCNQ5-nucleic acid probes.

39. In a computer system, a method of screening for mutations of a human KCNQ5 gene, the method comprising the steps of:

(i) entering into the computer a first nucleic acid sequence encoding a KCNQ5 polypeptide having a nucleotide sequence of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3, and conservatively modified versions thereof;  
(ii) comparing the first nucleic acid sequence with a second nucleic acid sequence having substantial identity to the first nucleic acid sequence; and  
(iii) identifying nucleotide differences between the first and second nucleic acid sequences.

40. The method of claim 39, wherein the second nucleic acid sequence is associated with a disease state.